

2 Systematic Literature Review of Empirical Support Regarding BPMS and BPMM Models

“But BPM promises more, including faster cycle times, lower costs, improved compliance with policies and best practices, and more agile response to change. BPM cannot achieve those benefits, however, by modeling and monitoring alone. A technology platform that can transform process models and metrics into executable implementations - without writing code - is required. In short, a BPM suite (BPMS)” (Silver 2007, p. 1).

In this chapter, I focus on evaluating the claims of the benefits of using Business Process Management Systems (BPM Systems, Suite or Software) and Business Process Management Maturity Models (BPMM) to achieve operational and business performance. At this point of my research, I focus on using Systematic Literature Review (SLR) as an exploratory tool to find empirical studies. I aim to provide insights into the role of BPMS and BPMM models in real-life situations by using the SLR as a kind of a theory landscaping for identifying those concepts and relationships that rise directly from the empirical studies and either support or negate the claimed benefits. According to Okoli (2012, p. 41), “Theory landscaping reviews do not aim to make definite theoretical arguments, but they do point to the theoretical relationships that the literature reveals or suggests.”

2.1 Design of SLR for BPMS

For the first SLR, I demand the presence of BPMS in the results, which according to many prior definitions are considered to be instrumental and even required for achieving the claimed benefits. Therefore, the purpose of this SLR is to answer my first research question.

(RQ1): What empirical support exists concerning improving firm performance using BPMS?

BPM and BPM Systems/Suites/Software (for simplification only Systems is used later in this study and it should be noted that BPM Suites and Software are considered as synonyms though seldom used in the literature) are often mixed. Un-

fortunately, I have been unable to find definitions for BPM and BPMS that would clearly disclose all its key elements - not even from major influences. Thus, I present the following working definitions based on often-cited publications that is consistent with the most adopted views of interests in BPM field.

- “BPM is a field of knowledge at the intersection between Business and Information technology, encompassing methods, techniques and tools to analyze, improve, innovate, design, enact and control business processes involving customers, humans, organizations, applications, documents and other sources of information” (van der Aalst et al., 2003, p. 1).
- BPMS is “A complete set of integrated composition technologies for managing all aspects of process — people, machines, information, business rules and policies supporting a full process discovery, analysis, design, development, execution, monitoring and optimization cycle, in which business professionals and IT collaborate as peers” (Sinur and Hill 2009, p. 3).

In addition, I use Davenport’s (1993, p. 5) definition of business process as “a structured, measured set of activities designed to produce a specified output for a particular customer or market.”

Even though I do not presuppose any criteria of measures for operational and business performance, my implicit assumption is that, in general, the operational benefits are measured using two dimensions; effectiveness and efficiency (DeToro and McCabe 1997), and business performance in terms of direct impact to financial and non-financial performance with quantitative and qualitative indicators.

First, I introduce the SLR method design and then resulting data, and finally conduct a review of the results and my conclusions.

The SLR consists of three phases: planning, conducting the review, and reporting the review. First, I present the research method and the resulting data, and then present my analysis of that data. The SLR design consisted of an automated search of the following digital libraries:

1. EBSCO Host – Business Source Elite databases
2. Association for Computing Machinery (ACM)
3. IEEE/IET Electronic Library (IEL)
4. Emerald
5. Science Direct

In addition, I manually searched all the issues of the following journals: *Academy of Management Journal*, *Academy of Management Review*, and *Business Process Management Journal*, from 2000 until 2010.

Synonyms and abbreviations for the main terms were identified. I executed automated search attempts to all five before mentioned digital databases for articles for peer-reviewed scholarly articles, proceedings, or case studies published since 2000. Search terms used were the exact matches of Business Process Management System/s, Business Process Management Suite/s, Business Process Management Software, and the most common acronyms; BPMS, BPM System/s, BPM Suite/s, and BPM software. I searched separately the document title, keywords, and abstract to cover studies dealing with empirical topics.

From the retrieved articles I excluded the rhetorical, opinion-based, theoretical articles, and studies that focused on evaluating academic or experimental BPM implementations through a prototype rather than a real-life application in industries or businesses. Only the empirical studies and surveys were retained. The selection was based on reviewing the abstract and conclusions of the research article and irrelevant articles were rejected. These articles were supplemented by another set that were handpicked based on my search from *Business Process Management Journal*, and from the reference lists of all considered articles – these articles were subject to the same criteria defined above.

2.2 Data Gathering

By extracting and categorizing relevant research, I aim to provide a quantitative overview of the empirical research of BPMS. The results of the search are presented in Appendix 0. In categorizing the studies: methodology, source of subject sample, and process domain where BPMS has been applied, are shown as initial characteristics. Additionally, the goals of the initiative, the BPMS features that could be recognized in the case description, as well as additional technologies reported to have significance are addressed. Finally, a quality appraisal about each study is presented.

I conducted the search during 19.01.-10.2.2010 focusing on the scholarly literature that consists of academic journals and conference proceedings where the articles are normally peer-reviewed. The authors are usually academics but practitioners are also well represented in the case study type of articles.

All articles found by the automated search were counted and complemented with articles from my manual search. From the resulting set I extracted the articles

that matched the criteria defined before. Out of all search results, 100 articles were identified to concern BPMS features. Out of this 100 BPMS related articles, 10 fit the designated criteria, and from these 10 articles, the automated search had found 8 and 2 by the manual search.

To illustrate the upsurge of interest in BPMS, I sorted the full set of relevant publications by year, and present the results in Figure 2.

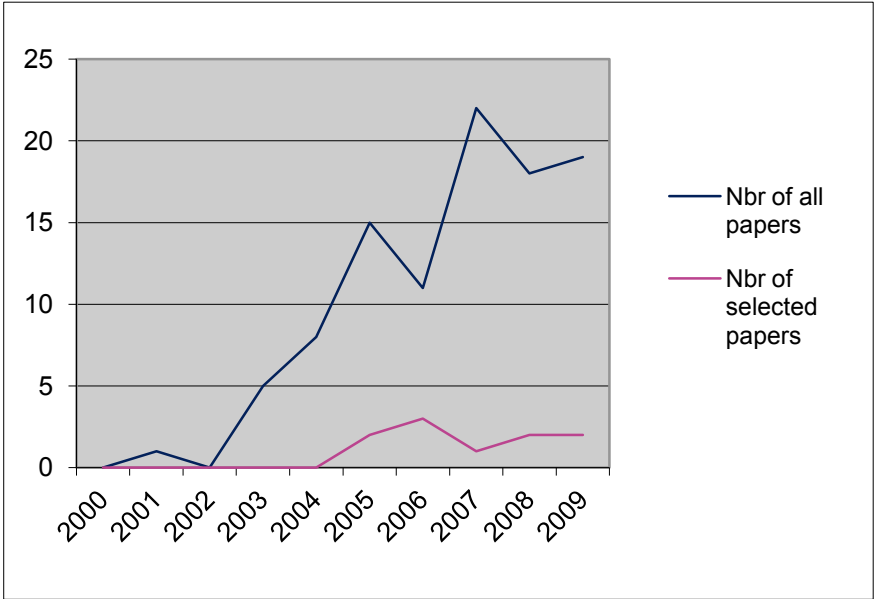


Figure 2. Comparison of annual volume of discourse compared to my resulting set of publications covering empirical evidence about BPMS

Using a similar approach as Baskerville and Myers (2009), I have considered whether BPMS is just another IS fad. They used a bibliographical review to investigate IS fashion waves by measuring the volume of discourse about a particular fashion. They defined an IS fashion as a phenomenon that gained substantial interest in both academic and practitioner literature at one time but is at present considered to be a thing of the past. Their resulting list of IS fashion waves included BPR, however, they also noted that for BPR, the scholarly interest was still ongoing after its peaking in 1994.

I chose to search for articles as far back as 2000 to allow a big enough time interval to identify when the first BPMS related articles started to occur. My manual search of Business Process Management Journal issues of 2000-2003 were all related to BPR and ERP and thus were excluded from all counts. First occurrence related to BPMS is from 2001 (Debenham 2001), though it did not contain any empirical support, and therefore the first occurrence that matched the criteria is from 2005 (Zimmerman et al., 2005).

The number of BPMS related articles started to grow after year 2003 and peaked in 2007 with 22 occurrences, and that level of occurrences has remained until the end of 2009 with 19 occurrences. However, the number of articles that matched the criteria, on other words, included empirical knowledge, has the average of 2 occurrences per year during 2005-2009. The manual search of Academy of Management Journal and Academy of Management Review did not result to any occurrence, which could imply that BPM had not yet reached attention as a considerable management practice. Whereas the overall number of articles has remained close to the peak of 2007, the level of empirical evidence has so far remained low. This presents the support that BPMS have been empirically under-researched in the BPM community before 2010. Even though the resulted evidence is scarce, I continue in the following to explore the key concepts and relationships from the resulted studies.

2.3 Review of the Findings for BPMS Empirical Evidence

Based on my systematic review, the quality of empirical support varied significantly. Only two studies (Küng and Hagen 2007; Zimmerman et. al, 2005) out of ten provided information to identify what BPMS features were used and what support was given to support the benefits. In the following, I present a summary of the relevant studies. Following Webster and Watson's (2002) instructions, I have collected identified concepts into Appendix Table 12.

In the first of the two most relevant articles, Zimmerman et al. (2005) described the Service Oriented Architecture (SOA) initiative of a large telecommunication wholesaler in a very detailed way, where Business Process Choreography (BPC) played a major role in automating the order management process. The BPC included process design and enactment based on a Business Process Execution Language (BPEL) connected to underlying infrastructure through SOA-based services. The case study covered the project and technological approach, and presented the benefits gained and lessons learned. Even though this study could be considered rather a

SOA study than BPMS, the main findings supported the SOA-enabled BPMS. However, the process design and enactment based on BPEL was seen to be immature in that it required semi-manual or manual steps between business analysis and development. While many aspects of case studies dating from 2005 might not hold today, this issue of navigation and synchronization between the business analyst's process design and the developer's enactment is a well-recognized issue still today.

The second most relevant article is a case study performed by K ng and Hagen (2007), which covered three process domains with various improvement goals. The study describes the business objectives of the process improvement and technological solution in detail, and merits especially in its clear description of the business benefits. The main finding was that through the combination of process restructuring and the application of modern IT, and specifically when process design and enactment is connected to SOA infrastructure, processes can be improved significantly.

The other end of the quality spectrum was demonstrated in studies that were closer to commercial product descriptions and marketing material, for instance, Callas (2006) and Miers (2006). Such studies either did not give the details of implemented BPMS features or were very broad in their description of the benefits gained. None of these studies provided any evaluation of the validity of their own results.

BPMS has been applied to a variety of businesses and process domains. The case studies presented in Appendix 0, show that out of 12 case studies (note that Reijers 2006, included 3 cases in his study), 2 cases were from telecommunication, 2 cases from banking, and the one each from the following business domains: energy, mortgage, insurance, asset management, industrial manufacturing, forestry, educational, and contract manufacturing. Consequently, the coverage of process domains was equally extensive and divergent. Most cases concentrated on human-centric processes, in other words, the improvement and optimization of processes that involved human participation.

Beyond the variety in business domains and types of the processes, the BPMS features also varied widely. Surprisingly, business rule repository and design were not mentioned explicitly in any of the case studies. When investigating the technological success factors of using BPMS features, I identified the following issues. The maturity of BPEL capabilities for process design and enactment stage was criticized by Zimmerman et al. (2005). Despite this, the BPEL was also used as a process design tool, though according to Ko et al. (2009), it belongs more to the process enactment stage. Moreover, Zimmerman et al. (2005) considered the extensions to the pure BPEL, and the introduction of many tech-

nology stacks to be success factors for the BPMS implementation. Therefore, these findings could suggest that the immaturity and the misuse of BPMS features in the course of the implementation may be the true source of these risks. In addition, what processes to expose, as well as the careful architectural positioning of process enactment in existing infrastructure, may increase the risks. When considering the relationship between the process modeling capabilities of BPMS and information modeling, the finding confirms the Seethamraju and Marjanovic's (2009) results indicating that business processes incorporate textualized and often emergent knowledge, and it is not sufficient to prescribe such emergent knowledge with a process model. In addition, the relationship of static information models to the success of Business Process Improvement (BPI) is not supported. This finding suggests that the dynamic and emergent nature of managing business process improvement may necessitate new approaches for information modeling, information sharing, coordination, and exchange.

Only one of the studies (Chalaris and Vlachopoulos 2009) defined their BPM implementation approach, otherwise none of the studies described their BPM method. This finding coincides with the empirical survey conducted already in 1995 by Elzinga et al. (1995). They found out through a survey of major US companies that in spite of the interest to BPM, the approaches for implementing BPM varies per company to company. Also Neubauer (2009, p. 166) reports in an empirical study conducted during 2006 that, "although the majority of the participating companies are involved with BPM initiatives, only a very small number of companies follows holistic approaches." I argue that this finding sheds more light on the relationship between BPM and BPMS. If the approaches of implementing BPM vary widely and do not follow nor share holistic methods, can the success of BPM be attributed only to technological capabilities employed in BPMS?

The resulting, even though a very limited body of support suggests, that the use of BPMS has a positive influence on the ability to change business process structures, and that the use of BPMS is positively associated with BPI success and firm performance. Even though no kind of management of process excellence teams were explicitly mentioned in any of the cases, many human resource development concerns were raised. For instance, Reijers (2006) pointed out that the introduction of both new work procedures and a new support system was considered by some end-users as too much change at one time. He also noticed that the end user acceptance for BPMS grew when they got more involved in updates and improvements. Also, the following critical success factors (CSFs) were identified by Zimmerman et al. (2005): scheduling proof-of-concept (PoC) early in the project along with the high-level outlining of the solution, iterative and incremental style based on agile

development, e.g., continuous delivery and collaboration, investment in an analysis phase involving several fact-to-face workshops within the architecture, and with the development and system administration teams, the early identification of the possible areas of concerns, and the definition for appropriate risk mitigation strategies before initiating any premature implementation work.

In summary, the results of systematic literature review shed light on the technology-driven changes and implications that are enabled by BPMS capabilities. As a conclusion of the review, there does exist, albeit very limited empirical support of BPMS benefits for a variety of business and process domains, the choice of BPMS features used, and the level of automation achieved. Interestingly, instead of mere automation of business processes, the tendency in the cases was toward optimizing human centric processes. My SLR results have similarities with Ravesteyn and Batenburg's (2010) survey to identify the CSFs of BPMS implementation answered by 39 Dutch consultants. Their results revealed that "developers and consultants with a specific BPM experience more strongly believe that applying BPM enables organizations to improve processes and IS/IT in a more flexible and adaptive way" (*ibid.*, p. 504). They also concluded that the most prominently supported CSFs were communication, involvement of stakeholders, and governance. In addition, they argued that BPMS implementations should not be seen merely as IT projects but should be advocated with a top-down approach by top management (*ibid.*, p. 504).

Okoli (2012) recommended that the synthesis stage of a theory landscaping review should focus on building a nomological network. He explained that the nomological network should include, for example, the relationships between various stakeholders, technologies, and environmental impacts. Benbasat and Zmud (2003) recommended that for constructing the nomological network, the constructs involved should be intimately related to the IT artifact. However, Agarwal and Lucas (2005) criticized Benbasat and Zmud for focusing only on micro-level research and argued for the need to conduct research that has a macro-level perspective instead. Accordingly, with so many business process concepts and cases to consider, I have illustrated a nomological network that would be useful for understanding the concepts and relationships as shown in Figure 3. I have emphasized BPMS as the core IT artifact and its impact on micro- and macro-level outcomes and consequences. I also consider it to be of importance how the impact of BPMS use further effects the redefinition of the enterprise-level goal function on the macro level. The goal function can be understood as a collection of various financial and non-financial interests. The dotted lines in the figure imply low support apparent in the SLR findings.

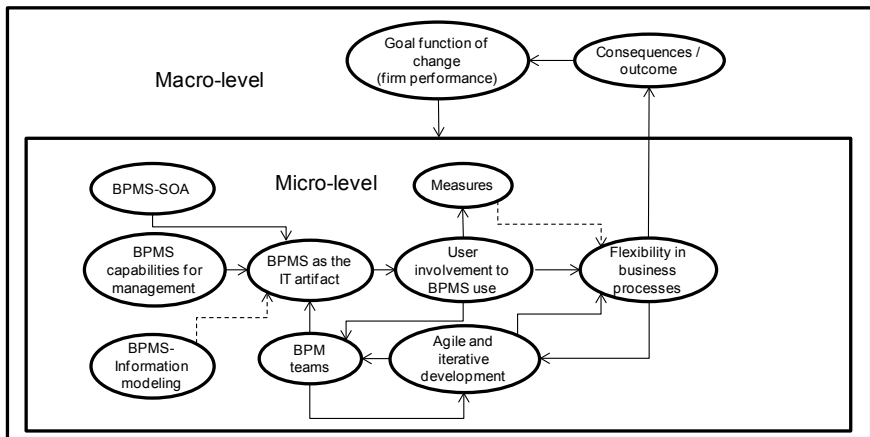


Figure 3. The nomological network of BPMS

It has been suggested that three critical elements: people, process, and technology need to be kept in balance (e.g., Alter 2006; Mangan and Christopher 2005; Quinn 2004). I have categorized the identified factors to influence BPMS success according to these broad elements as presented in Table 1.

People	Process	Technology
- Scheduling proof-of-concept (PoC) early in the project - The early identification of possible areas of concerns - Investment in an analysis phase involving several fact-to-face workshops within the architecture	- Careful selection of which processes to expose for improvement / change - Careful architectural positioning of process enactment in existing infrastructure - Iterative and incremental style based on agile development	- Avoiding misuse and immature BPMS features in the course of the implementation - Link process model and rule to execution directly - Connecting process design and enactment to SOA infrastructure improves processes significantly - Avoiding extensions to the pure BPM standards (BPEL) - Limiting the introduction of many technology stacks

Table 1. The resulted success factors identified from the empirical studies

2.4 Systematic Literature Review for BPM Maturity Models

In the previous sections, I presented some empirical support, though very limited, for the claims attributed to Business Process Management Systems (BPMS) benefits. My results supported also prior views showing that companies do not follow any generally established BPM implementation approach or method. However, Agarwal and Lucas (2005) called for a research that has a greater macro focus than those concerning constructs involved intimately related to the IT artifact. Reijers (2006) cautiously argued that there is a relationship between how ‘mature’ a company is in terms of business process orientation (BPO), and with the success rate of their BPMS implementations. Coincidentally, in the IS discipline, ‘maturity’ is regarded as “a measure to evaluate the capabilities of an organization” (Rosemann and de Bruin 2005a, p. 1). Therefore, in the following sections, I investigate what steps lead to increased BPM maturity, on other words: organizational capabilities for BPM, that lead to improved firm performance. BPMM models are considered to consist of stages or levels that an organization must go through.

The purpose of my second SLR is to answer my second research question.

(RQ2). What steps in the suggested pathways of BPMM models are empirically supported?

I first elaborate the concept: BPM Maturity model, and then introduce a set of well-known BPMM models, which serve as a theoretical background for subsequent literature review of empirical evidence of the relationship between BPM maturity and firm performance. Second, the design of my SLR is illustrated and the research results are presented and discussed. Finally, the review and analysis of the results are presented.

Similarly to my first SLR for BPMS influence on firm performance in the previous sections, I do not define any predetermined criteria of measures for operational and business performance, but generally expect that effectiveness and efficiency (DeToro and McCabe 1997) measures are used for operational performance, and that business performance is measured in terms of financial and non-financial performance with quantitative and qualitative indicators. I assume more variety of the used measures to be given in the resulting studies.

2.5 Introduction to Business Process Management Maturity Models

The basis of BPMM models is the stage model, which was originally suggested by Nolan (1979). He said that the stage models could be viewed as learning models to help organizations move from one stage to the next. Key characteristics for the models are that:

1. Stages are sequential in nature, and
2. Stages occur within a hierarchical, and often irreversible, progression (ibid.).

Later, the concept of the maturity model has emerged to facilitate the evaluation of organizational capabilities by outlining anticipated, typical, logical, and desired evolution paths (Becker et al., 2009). In addition, Paulk et al. (1993) stressed that improved maturity yields an increase in the process capability of the organization.

Maturity models have been subject to criticism. Existing maturity models are said to lack a sound theoretical foundation or are derived on the basis of an arbitrary design method (Röglinger et al., 2012; Lahrman et al., 2010; Biberoglu and Haddad 2002). Also, they are claimed to oversimplify reality and lack empirical foundation (McCormack et al., 2009; de Bruin et al., 2005; Benbasat et al., 1984; King and Kraemer 1984). In particular, maturity models neglect the potential multiple and equifinal paths for maturity (Teo and King 1997). According to King and Kraemer (1984), most maturity models focus on the sequence of levels or stages toward a predefined “end state” instead of the factors that actually influence evolution and change.

When investigating BPMM models in particular, Jeston and Nelis (2008a, p. 314) argued that a “BPMM model is a tool that can assist organizations in becoming more successful with BPM, resulting in the achievement of greater operational and business performance benefits.” McCormack and Johnson (2001) defined process orientation as an organization that, in all its thinking, emphasizes process with a special emphasis on outcomes and customer satisfaction. Therefore, the highest process capability would be when the organization has a special emphasis on outcomes and customer satisfaction. Moreover, it is important to note that the maturity of the management of business processes is measured – not the maturity of the business processes. Barney and Wright (1998) argued that to realize the full competitive potential of its resources and capabilities, a firm must organize its business processes efficiently and effectively. Process orientation

has not yet been recognized as an independent discipline but rather as a representation of various management philosophies, which use process perspective to improve business performance (Škrinjar et al., 2008; Lindfors 2003).

Since hundreds of maturity models exist, I have chosen to present the following models from the BPM literature for the following reasons:

- Capability Maturity Model (CMM) is considered to be the origin of the process maturity thinking and therefore provides a good comparison for the other models.
- Business Process Maturity Model from Object Management Group (OMG) was developed directly from CMM and reflects the business process views, in contrast with the software basis of CMM.
- Business Process Maturity Model from Gartner includes a path orientation and addresses Critical Success Factors (CSFs) for each level of maturity.
- Process and Enterprise Maturity Model (PEMM) from Michael Hammer, a co-founder of Business Process Re-engineering (BPR), was presented in the influential journal *Harvard Business Review*, and also includes a strong stepwise path orientation.
- McCormack and Lockamy's BPM Maturity Model is supported by global quantitative evidence of the critical components associated at each level of maturity (McCormack et al., 2009, p. 792; see also Lockamy and McCormack 2004).

In the following subsections, I outline each maturity model.

2.5.1 *Capability Maturity Model*

Process maturity model thinking is considered to have begun at the U.S. Department of Defense and Software Engineering Institute (SEI) through the development of Capability Maturity Model (CMM) at Carnegie Mellon University in the late 80s. CMM was primarily intended for assessing contractor's ability to deliver contracted software. It also describes a stepwise improvement path for software organizations from an ad hoc to a mature level. SEI created a five-step model that describes the levels that an organization moves through as it evolves from an immature organization to a mature organization where all processes are measured, managed, and consistently performed. Figure 4 illustrates the five CMM levels.

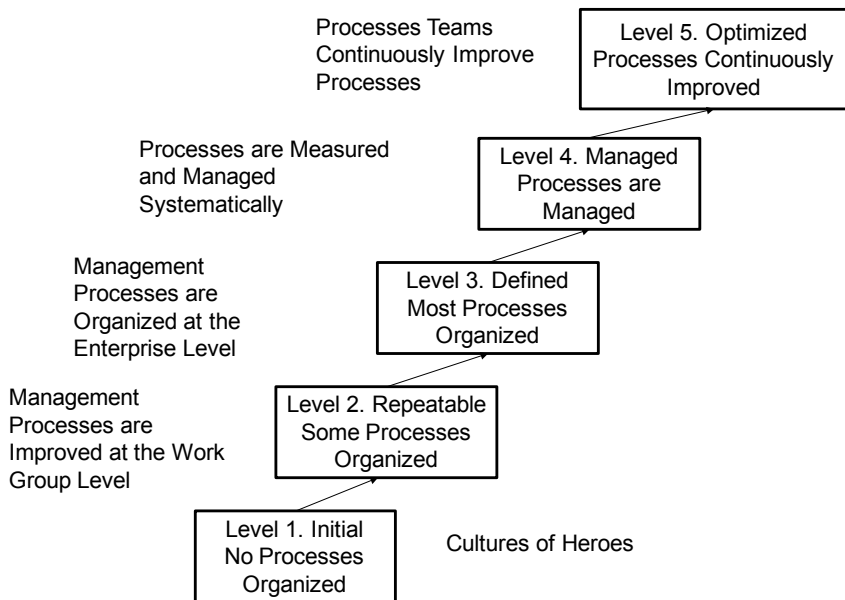


Figure 4. The CMM five levels of maturity (adapted from Harmon 2009, p. 1)

According to SEI's (2007) statistics, Critical Success Factors (CSFs) for CMM-based process improvements are the commitment of management and staff at all levels, strong enterprise process infrastructure, supporting tools, training and communications, and sufficient enterprise function and program resources.

2.5.2 The Business Process Maturity Model by OMG

The Business Process Maturity Model (BPMM) standardized by Object Management Group, is an adaption of the CMM. The evolution from CMM to BPMM can be traced to Nedbank Limited in South Africa where it was discovered that the benefits gained with CMM for software development could also be achieved in the rest of their banking operations (OMG 2008). Nedbank developed a Services Operations CMM and made it available for the international community, and finally it evolved into BPMM. OMG's BPMM focused on the improvement of the business processes that takes a form of cross-functional workflows.

OMG described BPMM as “an evolutionary improvement path that guides organizations in moving from immature, inconsistent processes to mature, disciplined processes. The BPMM guides these stages so that improvements at each stage provide a foundation on which to build improvements undertaken at the next stage. An improvement strategy drawn from the BPMM provides a roadmap for continuous process improvement. It helps to identify process deficiencies in the organization and guides the improvements in logical, incremental steps” (OMG 2008, p. 66). Figure 5 illustrates the five levels of process maturity.

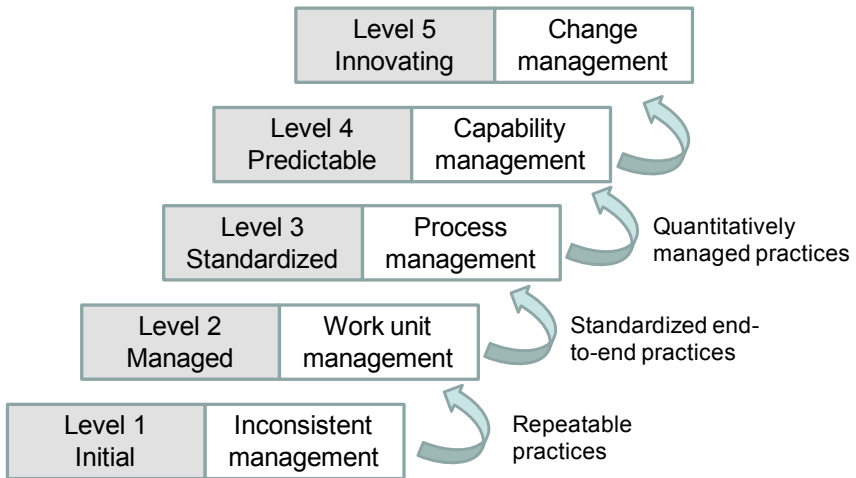


Figure 5. The five levels of process maturity of BPMM (adapted from OMG 2008, p. 66)

2.5.3 The Business Process Management Maturity Model by Gartner

Gartner, a major information technology research and advisory company, constructed a six-phase BPM maturity model and defined critical success factors for their BPM maturity framework. Gartner claim that their BPM maturity model provides guidance for how “organizations can more easily navigate the challenges of becoming process managed” (Melenowski and Sinur 2006, p. 1). Figure 6 illustrates the six phases of the process maturity.

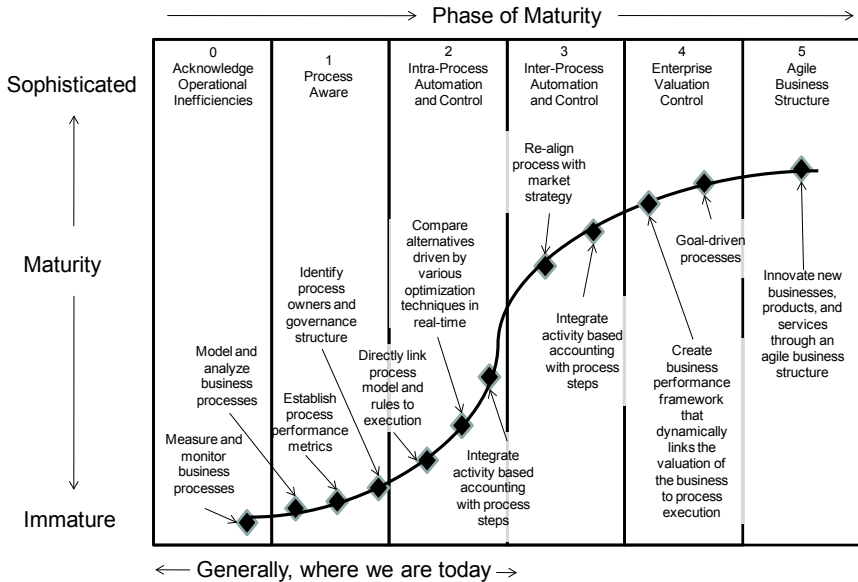


Figure 6. The six-phase model of process maturity (adapted from Melenowski and Sinur 2006, p. 1)

Gartner's concept of BPM maturity is based on the belief that superior process management leads to a truly agile business structure. Each phase in the maturity model builds on the previous phases. The path from Phase 0 towards more mature phases starts when conventional approaches do not provide solutions for business process improvement opportunities. Companies become "process aware" in Phase 1 when fundamental operational changes are introduced, processes are modeled and governance structures established. In Phase 2, process modeling and governance may enable process automation and better control. In Phase 3, the boundaries of processes are expanded and integrated with each other as well as with customers and partners. In Phase 4, process execution and strategic goals are linked when competencies have achieved in managing the major business processes, which ultimately leads to an agile business structure. In Phase 5, new products and services are created through innovative and agile business structures.

2.5.4 *Process and Enterprise Maturity Model*

Hammer, the co-founder of the Business Process Re-engineering (BPR), developed a process maturity model called Process and Enterprise Maturity Model (PEMM) that “centers on five characteristics that enable any process to perform well on a sustained basis and four enterprise capabilities that allow processes to take root in organizations” (Hammer 2007, p. 112). The five process enablers are (ibid., p. 113):

- Design: Comprehensive specification of how the process is to be executed.
- Performers: Skilled and knowledgeable people who execute the process.
- Owner: A senior executive who has responsibility for the process and its results.
- Infrastructure: Information and management systems that support the process.
- Metrics: The measures the company uses to track the process’s performance.

The four enterprise capabilities are:

- Leadership: Senior executives who support the creation of processes.
- Culture: The values of customer focus, teamwork, personal accountability, and willingness to change.
- Expertise: Skills and methodology for process redesign.
- Governance: Mechanisms for managing complex projects and change initiatives.

These process enablers and enterprise capabilities are each broken down into four levels of maturity. A company progresses a stepwise path in the beginning with the basics in enterprise capabilities, which form the foundation for the first changes in process enablers. This progress allows then a further advancement in enterprise capabilities as illustrated in Figure 7. This alternating progress between enterprise capabilities and process enablers continues until the company reaches the highest level of maturity. Hammer (2007, p. 118) claims, “Stronger organizational capabilities make for stronger enablers, which allow for better process performance.” The enterprise must have E-1 capabilities, that is; some teamwork experience within company must be present in the enterprise’s leadership, culture, expertise, and governance to pull its processes into the P-1 level; processes are reliable and predictable, they are thus stable. Accordingly, when all four capabilities reach E-2, the processes can proceed on P-2 and so forth.

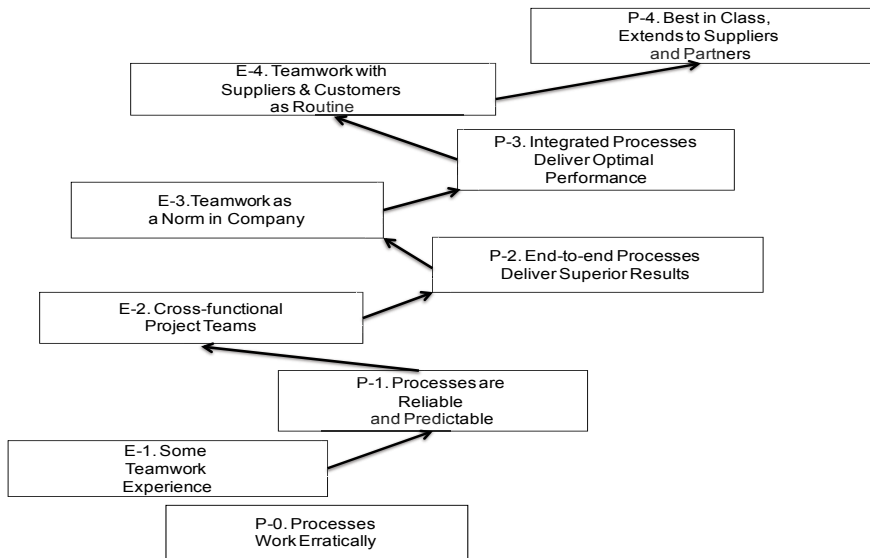


Figure 7. A stepwise path towards higher level maturity builds on precedent levels within the enterprise capabilities (derived from Hammer 2007)

2.5.5 The Business Process Management Maturity Model by McCormack and Lockamy

McCormack and Lockamy's maturity model describes a four-step path to process maturity (McCormack 2007; Lockamy and McCormack 2004; McCormack and Johnson 2001). As with the other selected maturity models, the levels of their model build on the work of the previous steps. The levels are described as follows:

- “(1) *Ad hoc*. The processes are unstructured and ill-defined. Process measures are not in place and the jobs and organizational structures are based upon the traditional functions, not horizontal processes.
- (2) *Defined*. The basic processes are defined, documented and available in flow charts. Changes to these processes must now go through a formal procedure. Jobs and organizational structures include a process aspect, but remain basically functional. Representatives from functional areas (sales, manufacturing, etc.) meet regularly to coordinate with each other, but only as representatives of their traditional functions.

- (3) *Linked*. The breakthrough level where managers employ process management with strategic intent and results. Broad process jobs and structures are put in place outside of traditional functions.
- (4) *Integrated*. The company, its vendors and suppliers, take cooperation to the process level. Organizational structures and jobs are based on processes, and traditional functions begin to be equal or sometimes subordinate to process. Process measures and management systems are deeply embedded in the organization” (McCormack et al., 2009, p. 794).

McCormack et al.’s (2009) global research collected several years of data from over 1,000 companies in the USA, Europe, China, and Brazil. Their results identified the elements of BPM that stabilizes at the different levels of their maturity model. Based on their analysis of the maturity assessment data, certain BPM elements become evident at specific levels while others are barely registered. This suggests that the BPM journey from one maturity level to another goes through these “Turning points”. The levels and turning points that are necessary conditions to progress to the next level are as follows:

Turning points from Level 1 to Level 2:

- Process language
- Focus on documentation
- Knowing the customer’s needs and preferences
- Process measurement and management
- Endorsing teamwork and multi-skilling

Turning points from Level 2 to 3:

- Process measurement and management defined
- Consistent use of process metrics
- Realizing how employee performance is linked into process performance
- Employee training in adapting to process changes
- Process culture manifests itself in the regular use of process language

Turning points towards Level 4

- Process analytics and automated processes

2.5.6 Synthesis of the Steps of BPMM Models and Hypotheses

A summary of the BPMM models presented above is shown in Figure 8.

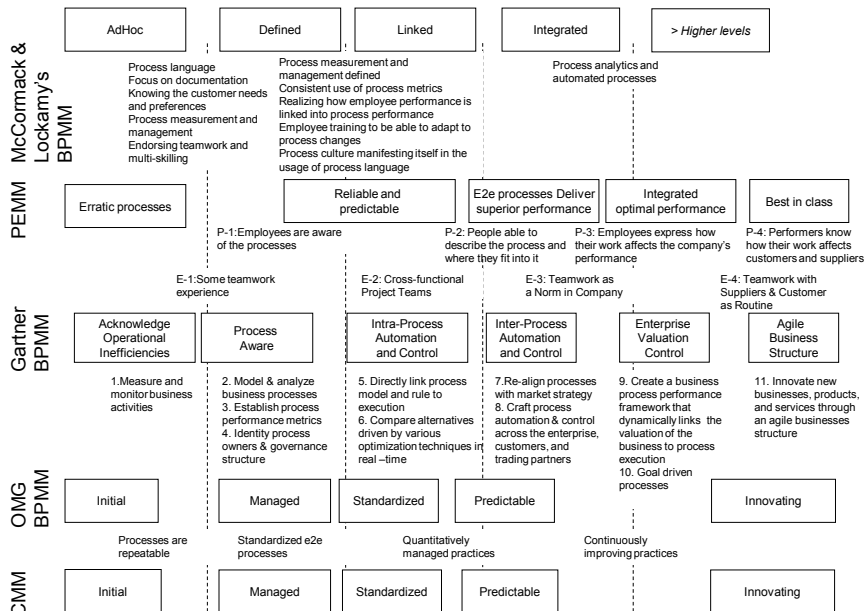


Figure 8. BPMM models (derived from McCormack et al., 2009; Harmon 2009; OMG 2008; Hammer 2007; Melenowski and Sinur 2006)

Many of the elements of these models have overlapping characteristics, such as turning points and process enablers, so I have synthesized a sequence of steps towards maturity for each level using the borders from McCormack and Lockamy's model as delimiters shown in Table 2. My purpose is not to create a new maturity model but to derive a model for linking empirical support to the steps suggested by the selected BPMM models. Empirical support hopefully should reveal which steps are relevant and if their order of completion is important. The steps under each level are listed in order of progress, for instance, where teamwork and multi-skilling are the first steps to realize in the company, and the next step is the measuring and monitoring of the business activities, and so forth. I acknowledge

that the list of the steps is not exhaustive, and some steps can be taken at the same time, or the order is not absolutely definitive.

Step nbr:	Step source	Step
Level 1		
1	McCormack et al., Hammer's PEMM	Teamwork and multi-skilling
2	Gartner BPMM, McCormack & Lockamy BPMM	Measure and monitor business activities
3	McCormack & Lockamy BPMM	Use process language
4	McCormack & Lockamy BPMM	Focus on documentation
5	McCormack & Lockamy BPMM	Know the customer's needs and preferences
6	OMG BPMM	Establish repeatable processes
Level 2		
7	Gartner BPMM	Model and analyze business processes
8	Gartner BPMM, McCormack & Lockamy BPMM	Establish process performance metrics
9	Gartner BPMM, McCormack & Lockamy BPMM	Define process measurement and management
10	McCormack & Lockamy BPMM	Use of process metrics consistently
11	Gartner BPMM	Identify process owners & governance structure
12	McCormack & Lockamy BPMM	Train employees in adapting to process changes
13	McCormack & Lockamy BPMM	Realize how employee performance is linked into process performance
14	Hammer's PEMM	Establish cross-functional project teams
15	OMG BPMM	Standardize business processes
Level 3		
16	Gartner BPMM	Link process model and rule to execution directly
17	Gartner BPMM	Compare alternatives, driven by various optimization techniques, in real-time
Level 4		
18	Hammer's PEMM	Teamwork is a company norm
19	Hammer's PEMM	Employees express how their work affects the company's performance
20	Gartner BPMM	Re-align processes with market strategy
21	Gartner BPMM	Craft process automation & control across the enterprise, customers, and trading partners
Higher levels		
22	Gartner BPMM	Create a business process performance framework that dynamically links the valuation of the business to process execution
23	Gartner BPMM	Teamwork with suppliers & customer is routine
24	Hammer's PEMM	Performers know how their work affects customers and suppliers
25	Gartner BPMM	Create new innovative businesses, products, and services through an agile business structure

Table 2. The suggested sequence of steps towards increased maturity

2.6 Design of Systematic Literature Review for Steps in BPMM Models

My review protocol consisted of an automated search of the following digital libraries:

- a. EBSCO Host – Business Source Elite databases
- b. Association for Computing Machinery (ACM)
- c. IEEE/IET Electronic Library (IEL)
- d. Emerald database
- e. Science direct
- f. Springer

Automated search attempts were made for within all six digital databases listed above peer reviewed scholarly articles. The search criteria were exact matches of “Business Process Management” and ([AND]) “Maturity Model[s]” targeted to the full text of the articles. Even though I selected only a few maturity models for detailed inspection, the search attempts were aimed to discover other potentially relevant maturity models of BPM. In case such models would be found, I would briefly inspect the descriptions of their influence on firm performance accordingly.

From the retrieved articles, I excluded the rhetorical, opinion-based, theoretical articles, and studies that focused on validating academic or scientific BPMM models through hypothetical research settings. Only case studies, surveys, and interviews were kept. Selection was based on reviewing at least the abstract and conclusions of the research article, irrelevant articles were rejected. The selected articles were thoroughly read. These articles were supplemented with a case study from the book “Management By Process: A Roadmap to Sustainable Business Process Management” by Jeston and Nelis (2008b), which I handpicked due to its in-depth coverage of a BPM maturity journey.

The studies were categorized according to methodology, company or business unit, and size. From there, I focused on identifying the business objectives of the organizations, BPMM models used, and the path that was taken in the organizations to increase their maturity. Finally, the summary of the results is presented highlighting what kind of successes or benefits were measured or experienced as outcomes.

The search was executed during July and August 2010. Articles published since then are not included. The results of the automated search were as follows:

- ACM Digital Library: 6 matches from which 0 was selected
- EBSCO Host (Academic Search Primer and Business Source Elite): 1 match from which 0 were selected
- Emerald: 65 matches from which 9 were selected
- IEEE Xplore: 62 matches from which 4 were selected
- Science Direct: 26 matches from which 3 were selected
- Springer: 9 matches from which 0 were selected

Altogether 170 non-redundant studies (169 from an automated search and one case study from the book) were explored for empirical support of BPM maturity models, and 17 studies out of 170 were finally relevant.

2.7 Data Gathering

By extracting and categorizing relevant research, I aim to provide a quantitative overview of the empirical research of selected BPMM models. In general, I grouped the selected studies into three categories that are analyzed in the following sub sections accordingly:

1. Large sample based surveys that supported the progress in BPM maturity stages and are supplemented with multiple case studies of similar confirming results. These studies are presented in the Appendix.
2. Multiple and single case studies that confirmed the increased effectiveness and efficiency or business performance when a company takes one or more steps described in the maturity models. These studies are presented in the Appendix Table 14.
3. Empirical research that results in conflicting or negating evidence of the need to progress along the steps of the maturity models in the prescribed order. These studies are presented in the Appendix Table 15.

2.7.1 Findings that Support the Progress along BPMM

McCormack and Lockamy's model is a result of collecting data from over 1,000 companies in several industries and countries over several years. Their research has mainly been about Supply Chain Management (SCM), though McCormack et al. (2009, p. 812) also comment about BPO, "The results from different continents, cultures and industries confirm the applicability of BPO concepts to a wide range of companies."

This study from McCormack et al. (2009) summarized many of their previous studies. Their studies provide the following empirical contributions: firms with BPO achieved better overall performance, and companies with strong measures displayed better group spirit with less internal conflict (McCormack 2001), process measures and process-oriented values and beliefs are critical ingredients of SCM systems, corporate survival in the internet economy will depend both on the effec-

tiveness of internal processes and the integration of those processes with the SCM of their partners and customers (McCormack and Johnson 2001), and finally, a strong and positive association exists between supply chain process maturity and firm performance (McCormack et al., 2008; Lockamy and McCormack 2004).

Three of the selected studies reported positive results about progressing from one level to another with regards to BPMM models. Palmberg's (2010) study presented positive results for three companies that progressed towards a process-oriented organization and achieved the "Linked" stage of the McCormack and Lockamy's BPMM model. Also, Sentanin et al. (2008) confirmed positive effects of the BPM efforts on non-financial performance; however, they called for more research about the effects on financial performance. In addition, Škrinjar et al. (2008) confirmed positive impact on non-financial performance, but surprisingly found no direct impact of BPO to financial performance.

Time period required to achieve a certain level of maturity was difficult to extract. However, the case study of Sentanin et al. (2008) described an effort that enabled the organization to progress into the "Defined processes" level within 33 months. Palmberg (2010) described how three case study organizations progressed to the "Integrated" level within 3 to 8 years. Even though the starting level was not clearly defined, the results suggest that progressing one or two (of the lowest) levels takes years, while no support to progress two levels within less than one year was found.

The aforementioned studies were all the empirical studies I could find at the time of the SLR, despite the fact that other BPMM models do exist. The empirical studies of Rosemann and de Bruin (2005a and 2005b) were found through the backward search from the selected studies. Their CMM based maturity model was tested in two Australian organizations by conducting both case studies and surveys. They claimed, "The findings confirm the model as having the potential to be very beneficial to organizations wishing to progress BPM initiatives" (2005b, p. 20). However, they (2005a, p. 11) also report "Second, at this stage we do not have empirical evidence for the correlation between the factors of the BPMM model and BPM success."

2.7.2 *Findings that Support One or Multiple Steps*

None of the studies confirms an overall stepwise approach from lower to higher levels as suggested in the selected BPMM models. Only study by Palmberg (2010) described how three companies reached the "Integrated" level of

McCormack and Lockamy's BPMM model but the stepwise approach to get there was not defined. The studies that confirmed either one or multiple steps in the sequence consistent with Table 2 were typically the case studies of specific BPM initiatives, projects with predefined business goals, or the studies of specific improvement initiatives over a longer period of time.

Based on my analysis, the most often realized steps were the following:

- Step 11 & Level 2. Identify process owners & governance structure, 5 cases
- Step 8 & Level 2. Establish process performance metrics, 3 cases
- Step 9 & Level 2. Define process measurement and management, 3 cases
- Step 10 & Level 2. Use of process metrics consistently, 3 cases
- Step 14 & Level 2. Establish cross-functional project teams, 3 cases
- Step 15 & Level 2. Standardize business processes, 2 cases
- Step 16 & Level 3. Link process model and rule to execution directly, 1 case
- Step 13 & Level 2. Realize how employee performance is linked into process performance, 1 case
- Step 19 & Level 4. Employees express how their work affects on the company's performance, 1 case
- Step 20 & Level 4. Re-align processes with market strategy, 1 case
- Step 12 & Level 2. Train employees in adapting to process changes, 1 case
- Step 21 & Level 4. Craft process automation & control across the enterprise, customers, and trading partners

This analysis is based on my interpretation of the explicit support from the case study findings and does not exclude the possibility of other steps being realized if more data had been reported in the selected studies. Also, Okoli (2012) suggested avoiding quantizing qualitative data in theory landscaping literature reviews because one might lose some potential insights.

These empirical studies covered a broad range of sectors with a slight concentration on process standardization initiatives. The project and single initiative case studies varied in study time periods from 6 to 30 months, while the longitudinal studies varied from 3 to 10 years. The only case study that faced a substantial delay compared to the initial goal was a low maturity organization that experienced a delay of 9 months, which yielded to a total of 12 months for the entire process (Reijers 2006).

The measures of firm performance used in the case studies include customer facing and financial key measures such as: share price, revenue, market share, supply chain measures, process benchmarks, order management and delivery

measures, productivity, operations costs, customer service, and retention (McAdam 2001). Internal and non-financial measures include: higher availability of the systems due to modular architecture, increased level of security, quality improvements due to better change management, more timely Human Resource (HR) reporting and data correctness and completeness, and learning and growth aspects (van Wessel et al., 2007). In addition, combinations of Balanced Scorecards, Business Excellence models, and various ISO standards (International Organization for Standardization) were used extensively.

A multiple case study by van Wessel et al. (2007) is a good representative of the results above. They described the selection, implementation and usage of company IT standards for process performance and showed that the “service quality and flexibility increased when using standardized products or processes, and simultaneously costs went down. Customer satisfaction depended on the level of business participation” (ibid., p. 190).

The level of BPM maturity was partially confirmed to be a possible cause for the negative impact on process automation. Reijers (2006) presented a BPMS initiative carried out in three case study organizations: the one with having a “red” maturity, where the lack of business process orientation was assumed to seriously jeopardize a successful implementation, was indeed faced with the most problems, whereas the other more BPM mature organizations succeeded smoothly.

The steps belonging to the higher maturity level were well presented in the case study by MacKay et al. (2008), who described a high performing business unit of a company that emphasized on “change management exercises being clearly linked to delivery of the CBN [Compelling Business Need] and receiving high levels of buy-in from all levels of the organization” (ibid., p. 32). This CBN was created every three years in collaboration with business partners and customers. Such an approach confirms the significance of continuously realigning strategies with processes.

2.7.3 *Findings that Conflict or Deviate from BPMM*

Some of the articles deviated from the view that business performance increases only as a company progresses along the business process maturity levels. The survey by Trkman et al. (2010) suggests one alternative explanation for such deviation to be that the use of business analytics has a strong impact on the performance of critical supply chain processes regardless of the BPO. Moreover, Trkman et al. (2010, p. 324) also state that "companies may use other ways to

cooperate without necessarily increasing their BPO at least in the short term” (ibid., p. 324) and that “It is quite possible that BPO is critical only in certain processes, depending on the focus of the company.”

These results are partially supported by the case study of Jeston and Nelis (2008b) where South African bank first successfully continued along the stages of CMM, but due to the negative impacts of macroeconomics and acquisition discontinued the process management function, yet they still revived remarkably. This revival was a result of focusing on a plan to “fix the business, consolidate and growth” plan (ibid., p. 60). This case study demonstrates that in certain circumstances it is not necessary to increase BPM maturity to improve firm performance. Other paths, even disruptive to BPM maturity, may turn out to be more successful.

The case study by Boersma and Kingma (2005) described how an organization was forced to shut down a sophisticated ERP system in order to recover from a production crisis, and needed to start over from a less mature stage to understand both the process and the ERP in a new way. This demonstrates that success with BPM can be achieved without unidirectional movement through BPMM stages. In addition, Seethamraju and Seethamraju (2009) not only confirmed a positive impact of integration and standardization of processes, but also noticed that the technical tight coupling of enterprise system infrastructure may limit the firm’s agility of creating new processes.

Also, the step (14) of establishing a cross-functional team is contradicted in one of the case studies where “the idea has been to mix employees from different market areas, and thereby have them work in the same way. However, this idea turned out to be difficult to realize, and therefore the organizational structure went back to specialized teams” (Palmberg 2010, p. 106). This finding confirms what Newell et al. (2001) addressed when they attempted to dispel the myth of the ‘boundaryless’ organization, and argued against technologically deterministic approaches to organizational change. Also, Niehaves and Plattfaut (2011) recently noted that collaborative BPM is a growing trend in information systems research, but that there is still significant gap in research.

2.7.4 *Summary of the Findings for BPMM Empirical Evidence*

The results of the SLR confirm that the importance of progressing along stages of a specific BPM maturity model is widely underinvestigated, with the exception of studies made by McCormack et al. (2009). Consequently, being the only model

with empirical support, the McCormack and Lockamy's BPMM model was also the most applied. From the reviewed studies, four papers either used or referred to the McCormack and Lockamy's model. The CMM model was also referred to in four papers, however, only two studies addressed the sequential progress of moving from one stage to another in CMM, and the other two only had a reference to the CMM model. The OMG BPMM was mentioned only in one paper, but that case study did not address or apply the model. Gartner's BPMM and Hammer's PEMM were not mentioned in any of the reviewed studies, though Hammer's primary study (2007) presents a collection of anecdotes about applying PEMM in the subject companies that increased business performance. Therefore, the only sign of credibility for this study is that it was published in an established and peer-reviewed journal. This leaves that the validity of the PEMM as open.

Based on my qualitative review, there is only partial support for the claim that progressing along the stages of BPMM models would yield to improved firm performance. The least supported areas emerge for the highest levels or turning points. From empirical research setting point of view, I argue that the most problematic aspect for the highest levels is in showing determinism. For example; the characteristic like process culture or agility in innovating with the customer, is difficult to associate with concrete steps along upward path. Even the most confirmed support related to BPMM turning points given by McCormack et al. (2009) acknowledged that the relationship between the elements (dependencies) was only suggested and not statistically supported.

Consequently, most evidence is inclusive and a few studies actually contradict with the claimed benefits of unidirectional and sequential progress along these stage models. My discussion is aligned with the conclusion of Phelps et al. (2007), who posited that there is little consistency either in the number of elements that define these models or in their constitutive components, and that they suffer from being linear, unidirectional, sequenced, and deterministic.

Therefore, I consider BPMM models to be useful instead as a measurement system to identify the level of BPO, rather than a prescriptive model for gaining firm performance. BPO can have different levels of maturity that can be identified with various BPMM models. However, the findings did not support that BPMM models can provide prescriptive methods to achieve these levels. Röglinger et al. (2012, p. 341) also concluded, "As for the prescriptive purpose of use, however, little concrete and documented guidance could be identified." Actually, to reach a certain level many routes can be taken though certain steps may indeed be necessary somewhere along the way. I have illustrated this conclusion in Figure 9.

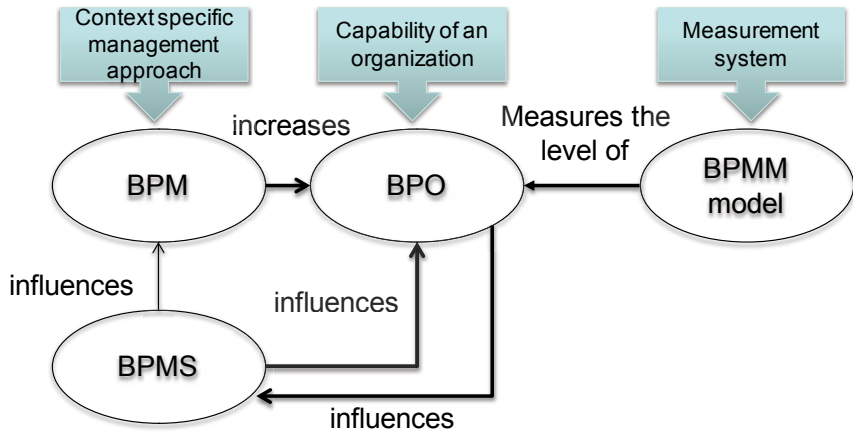


Figure 9. Model of the relationships between BPM, BPMS, BPO, and BPMM

I have collected steps that were most realized in the resulting support into categorized by people, process, and technological resource development dimensions.

People	Process	Technology
- Identify process owners and governance structure - Establish cross-functional project teams - Realize how employee performance is linked to process performance - Employees express how their work affects the company's performance - Train employees in adapting to process changes	- Establish process performance metrics - Define process measurement and management - Use of process metrics consistently - Standardize business processes - Re-align processes with market strategy	- Link process model and rule to execution directly - Craft process automation & control across the enterprise, customers, and trading partners

Table 3. The most realized steps in resulting studies

Steps to Improved Firm Performance with Business
Process Management

Adding Business Value with Business Process
Management and its Systems

Hyötyläinen, T.

2015, XVII, 220 p. 44 illus., Softcover

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